



# AN ATTEMPT TO UNDERSTAND AND ASSESS BACHELOR OF SCIENCE (MICROBIOLOGY) DEGREE PROGRAM IN UNITED STATES OF AMERICA

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## ABSTRACT

The main aim of this project was to understand, compare and evaluate structure of undergraduate Bachelor of Science (Microbiology) (B.S.) Degree Program in four US University. The purpose of this assessment was to contrast differences in Science Content and Professional courses offered in degree program. This study compared complete structure of a degree program of a University, and also provided an overview whether there are differences within Universities yearly structure program i.e. Freshman, sophomore, Junior and Senior year

**KEY WORDS:** Microbiology, United States of America, Undergraduate, Bachelor of Science.

## INTRODUCTION

In 2009, the reports from American Association for the Advancement of Science (AAAS) and Scientific Foundation for Future Physicians (Howard Hughes Medical Institute and American Association of Medical Colleges) suggested changes in how biology should be taught in 21st Century in a way students have a foundational understanding in Biology rather than factual knowledge. Introduction of subjects such as evolution, structure and function, pathways, information flow and systems was requested. In 2009, American Society for Microbiology acted upon the request by establishing a Curriculum task force to update ASM curriculum guidelines for Undergraduate Microbiology Education in United States. In 2011, this committee approved the focus of Microbiology Education with introduction of key concepts and skills which are central to Microbiology after revision of 25 undergraduate microbiology courses by the above task force. Finally in 2011, ASM General Meeting, and ASM conference for Undergraduate Educators the committee laid foundations for recommendation of these changes in microbiology curriculum from Spring, 2012 onwards.

## HYPOTHESIS

The overall purpose of B.S. (Microbiology) degree program is to increase content knowledge, technical and professional expertise in the area of biological sciences specifically microbiology. Successful completion of this degree program will prepare individuals to work in academia and industry by equipping both conceptual and application of acquired knowledge and laboratory experiences. Based on the guidelines of ASM, it was expected that there will not be much differences in science content and other professional courses.

## MATERIALS AND METHODS

Internet search tools such as Google Search, GradSchools.Com and Peterson Guide were used to select the institutions offering undergraduate program B.S. (Microbiology) undergraduate degree program within United States based on ease of finding the curriculum. The pdf copy of the program of study was downloaded, and division of courses was done basis of science content and other professional courses. Science courses were sub-divided into physics, chemistry, biology and mathematics. In Microsoft Excel file, total number of physics, chemistry, biology, mathematics and professional courses were calculated for every institution. Analysis was performed in excel by preparing Bar graphs ( Histogram) all the science courses offered within a degree program, and differences within all the four year ( on percentage basis).

The four institutions selected are as follows;

1. University of Idaho, Moscow, Idaho
2. Colorado State University, Fort Collins, Colorado
3. North Carolina State University, Raleigh, North Carolina
4. Miami University, Oxford, Ohio

## GRAPHS

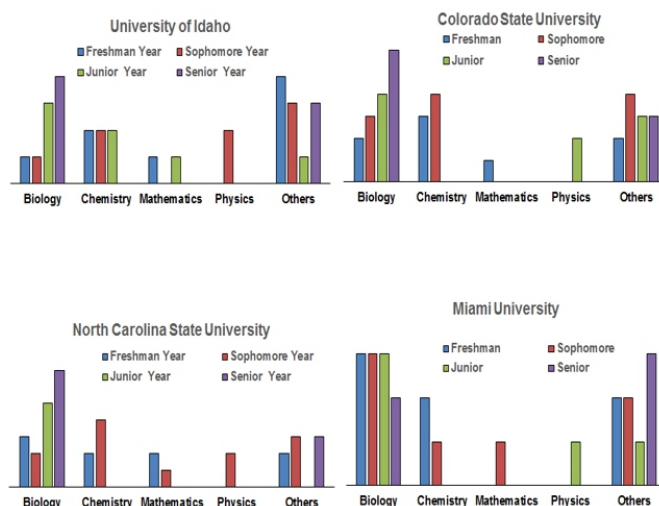


Figure 1.1: Comparison of Bachelor of Science (Microbiology) degree program in four Universities in United States.

Differences were observed in overall degree program with variability in science and other courses taught in above Universities. In all the four Universities above, Colorado State University and Miami University emphasized most on Biology courses, Chemistry courses was highest in University of Idaho, no major changes were observed in Mathematics and Physics content, however other professional courses were given least importance by North Carolina State University degree program.

## Freshman Year

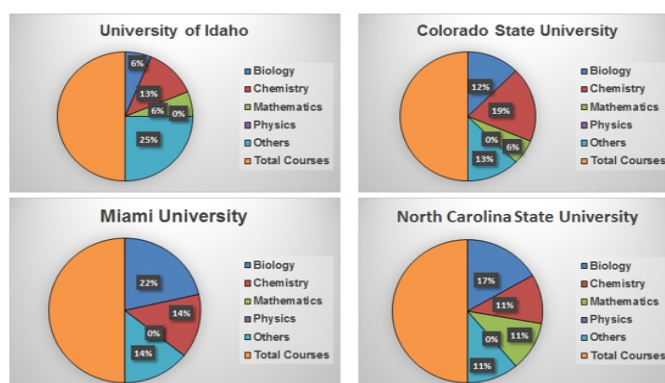
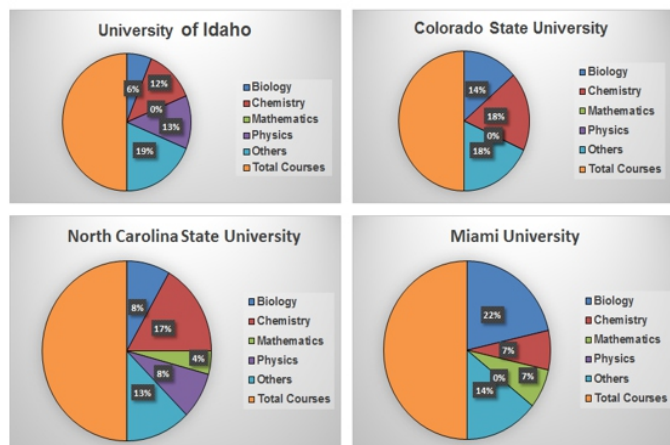


Figure 2.1: Comparison of Science and other professional courses during freshman year of B.S. Microbiology degree program.

University of Idaho offered least biology percentage of courses during freshman year of degree program in comparison to other three Universities used in this study. Chemistry content percentage knowledge was highest in Colorado State University in comparison to other three Universities. Miami University and North Carolina State University degree program offered similar percentage of Mathematics courses. In all the above four Universities, University of Idaho had maximum emphasis on other professional courses.

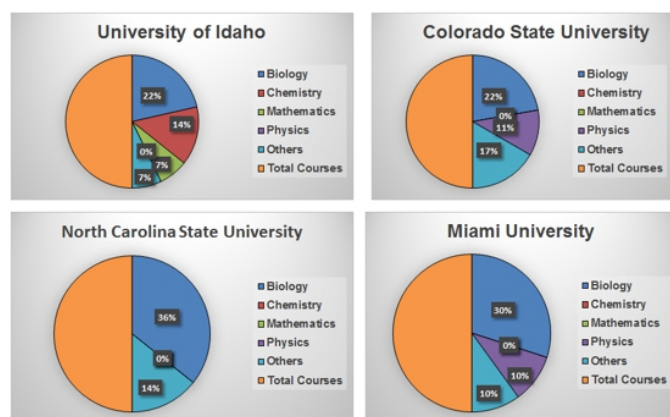
## Sophomore Year



**Figure 2.2: Comparison of Science and other professional courses during Sophomore Year of B.S. Microbiology degree program.**

In comparison to other Universities used in this study, Miami University offered highest percentage of Biology courses during Sophomore Year of degree program; however reduction in percentage of chemistry courses was observed. Percentage of Mathematics course in North Carolina State University and Miami University was similar; however no Mathematics coursework was offered by University of Idaho and Colorado State University. No change was observed for Physics and other professional courses offered.

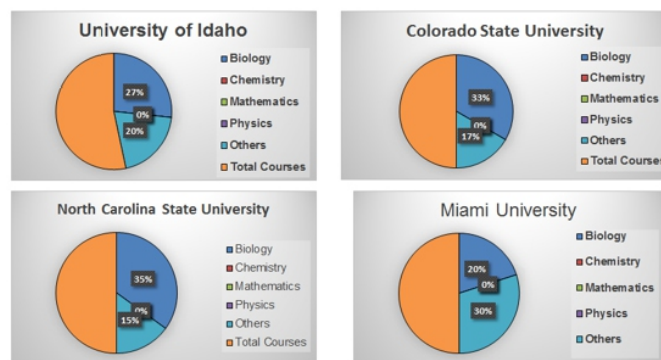
## Junior Year



**Figure 2.3: Comparison of Science and other professional courses during Junior Year of B.S. Microbiology degree program.**

North Carolina State and Miami University offered highest percentage of courses during Junior Year of this degree program in comparison to University of Idaho and Colorado State University used in this study. Only University of Idaho offered Chemistry and Mathematics coursework during Junior Year. Physics coursework was only offered by Miami University and Colorado State University during Junior Year. University of Idaho offered least professional coursework in comparison to other Universities.

## Senior Year



**Figure 2.4: Comparison of Science and other professional courses during Senior Year of B.S. Microbiology degree program.**

No comparable differences were offered in percentage of Biology courses offered by the above Universities during Senior Year. Physics, Chemistry and Mathematics courses were not offered in any of the above Universities. Miami University offered highest percentage of courses in comparison to all the above Universities.

## CONCLUSIONS

University of Idaho, Miami University, Colorado State University and North Carolina State University all offer Bachelor of Science (Microbiology) undergraduate degree four year program. This degree program requires completing sequences of courses in general biology, general chemistry, general physics and calculus along with professional courses to increase science communication and writing skills in Freshman Year. During sophomore year more emphasis were given to specialised courses in the area of microbiology with introduction of general chemistry and physics laboratory courses. More focussed courses in the area of microbiology and research was introduced.

Variability in percentage of Biology, Chemistry, Physics, Mathematics and other professional courses taught in a given year of this program was observed. These changes might impact knowledge, learning and application of concepts. The science content during the freshman year imparted knowledge in all of the above science courses whereas fluctuations in science content were observed from sophomore to junior year. In the senior year, balance between Biology and Professional courses was observed with more emphasis on specialised microbiology (both laboratory and coursework) so to finally prepare students for specialised needs of the academia and industry.

## RESOURCES

- Report from American Society for Microbiology  
[http://www.asm.org/images/final\\_curriculum\\_guidelines\\_%20w.\\_intro\\_4.12.2012-2.pdf](http://www.asm.org/images/final_curriculum_guidelines_%20w._intro_4.12.2012-2.pdf)
- The ASM Recommended Curriculum Guidelines for Undergraduate Microbiology Education were published in Journal of Microbiology and Biology Education (Merkel, JMBE May 2012, pp 32 – 38).
- Vision and Change a call to Report 2009  
<http://visionandchange.org/files/2011/03/VC-Brochure-V6-3.pdf>
- Vision and Change Report 2011  
<http://visionandchange.org/files/2013/11/aaas-VISchange-web1113.pdf>
- University of Idaho – B.S. (Microbiology) Curriculum
- Colorado State University – B.S. (Microbiology) Curriculum
- North Carolina State University – B.S. (Microbiology) Curriculum
- Miami University- B.S. (Microbiology) Curriculum